CSE221 Assignment 02 Spring 2025

A. Two Sum Trouble

time limit per test: 1 second
memory limit per test: 256 megabytes

Your little brother, Bob, loves playing with integers. One day, his teacher gave him a sorted list of ***N*** integers in **non-decreasing** order. Now, your brother wants to play a game with you.

Bob will give you an integer ***S***. You have to find if it is possible to find two values from the list (at distinct positions) whose sum is equal to ***S***.

Since you are feeling very tired, you decide to write a program that can quickly answer Bob's query.

Input
The first line contains two integers ***N*** $(1 \leq N \leq 10^6)$ and ***S*** $(1 \leq S \leq 10^9)$, denoting the length of the list, and the target Sum.

In the next line, there will be N integers $a_1, a_2, a_3 \ldots a_n$ $(1 \leq a_i \leq 10^9)$ in non-decreasing order, separated by spaces.

Output
Print two distinct 1-based indices ***i*** and ***j*** such that $a_i + a_j = S$ where $i < j$. If no such pair exists, then print **-1**. If multiple solutions exist, you may print any one of the valid answers.

Examples

input Copy
```
4 10
1 3 5 7
```
output Copy
```
2 4
```

input Copy
```
6 18
1 5 8 9 9 10
```
output Copy
```
3 6
```

input Copy
```
4 7
2 4 6 8
```
output Copy
```
-1
```

input Copy
```
4 10
1 5 6 8
```
output Copy
```
-1
```

Note
In the second sample input, 4 5 is also a valid output.

B. A Beautiful Sorted List

time limit per test: 1 second
memory limit per test: 1024 megabytes

Alice and Bob are two friends. Alice has a list of length ***N*** in **non-decreasing** order, and Bob has a list of length ***M***, also in **non-decreasing** order.

Now, they want to combine their lists into a single non-decreasing list of length **N+M**. However, they are not very good at algorithms, so they asked for your help.

Since you are a computer science student, your task is to write an efficient algorithm to merge the two given lists into one non-decreasing list. **Solve the problem in O(N+M)**.

Input
The first line contains an integer ***N*** $(1 \leq N \leq 10^6)$, denoting the length of Alice's list.

The second line contains N space-separated integers representing Alice's list.

The third line contains an integer ***M*** $(1 \leq M \leq 10^6)$, denoting the length of Bob's list.

The fourth line contains M space-separated integers representing Bob's list.

All the numbers given in the input will fit within a **32-bit signed integer**. It is guaranteed that the given lists will be in **non-decreasing** order.

Output
You have to make a sorted list in **non-decreasing** order from the given lists and show the output.

Examples

input Copy
```
4
1 3 5 7
4
2 2 4 8
```
output Copy
```
1 2 2 3 4 5 7 8
```

input Copy
```
3
2 10 12
6
3 4 6 7 8 9
```
output Copy
```
2 3 4 6 7 8 9 10 12
```

input Copy
```
5
1 2 3 4 5
2
10 12
```
output Copy
```
1 2 3 4 5 10 12
```

input Copy
```
4
1 2 12 13
3
10 15 18
```
output Copy
```
1 2 10 12 13 15 18
```

input Copy
```
8
1 2 3 8 8 10 12 14
9
1 1 4 5 6 8 13 15 16
```
output Copy
```
1 1 1 2 3 4 5 6 8 8 8 10 12 13 14 15 16
```

C. Longest Subarray Sum

time limit per test: 1 second
memory limit per test: 256 megabytes

You are given an array of ***N*** integers and an integer ***K***. Your task is to find the length of the longest contiguous subarray whose sum is less than or equal to ***K***.

Input

The first line contains two integers ***N*** ($1 \leq N \leq 10^5$) and ***K*** ($1 \leq K \leq 10^9$) — the size of the array and the maximum allowed sum.

The second line contains N space-separated integers $a_1, a_2, a_3 \ldots a_n$ ($1 \leq a_i \leq 10^6$) — the elements of the array.

Output
Print a single integer — the length of the longest contiguous subarray whose sum is less than or equal to ***K***.

Examples

input Copy
```
5 4
4 1 2 1 5
```
output Copy
```
3
```

input Copy
```
5 5
1 1 1 1 1
```
output Copy
```
5
```

input Copy
```
3 1
2 3 4
```
output Copy
```
0
```

input Copy
```
10 12
1 2 6 4 3 2 3 1 4 2
```
output Copy
```
5
```

Note
In the first example, possible subarrays with sum less than or equal to 4 are $[4], [1], [2], [1], [1, 2], [2, 1], [1, 2, 1]$. Among them, the longest size is 3.

In the second example, sum of the entire array is 5. Hence, we can take the whole array.

In the third example, no subarray has sum less than or equal to 1. Hence, the answer is 0.

D. Can you Iterate the Binary String?

time limit per test: 0.5 seconds
memory limit per test: 256 megabytes

You are given ***T*** test cases. Each test case contains a binary string ***S*** that follows a specific pattern:

- There will be zero or more 0s in the prefix of ***S***.
- There will be zero or more 1s in the suffix of ***S***.

For each string, find the index of the first occurrence of the character 1 in the **1-based indexing**. Find the output of each query in $O(log|S|)$.

Input
The first line contains an integer ***T*** ($1 \leq T \leq 10^4$) — the number of test cases. Each of the next T lines contains a binary string ***S*** ($1 \leq |S| \leq 4 \times 10^3$), where |S| represents the length of the string.

Output
For each test case, print a single integer:

- The first occurrence of the character 1 in the string S in the 1-based indexing.
- If there is no 1 in the string, print -1.

Example

input Copy
```
15
0000011111111
00000111111111
00000
0000
1111
111
0
1
01
01111
000000000000001
0000000000000001
00000000000011111111111111111111
000000011111111111111
00000001111111111111111111111111
```
output Copy
```
6
6
-1
-1
1
1
-1
1
2
2
15
16
14
8
8
```

E. Count the Numbers

time limit per test: 1 second
memory limit per test: 256 megabytes

You are given a sorted array a of n elements, and some queries. In each query, you are given a pair $[x, y]$ and you have to count how many numbers a_i are there such that $x \leq a_i \leq y$. For example, if the array is $[10, 20, 20, 45, 79]$ and you are given a query $[20, 50]$, then answer will be 3 because there are in total 3 numbers that's value is between 20 and 50.

Input
The first line of the input contains $n (1 \leq n \leq 10^5)$ and $q (1 \leq q \leq 10^5)$ denoting the array size and the number of queries respectively. The next line will contain the array elements separated by space where $1 \leq a_i \leq 10^9$ where $i = 0, 1, 2, \ldots, n-1$. Each of the next q lines will contain a pair $[x, y]$ where $1 \leq x \leq y \leq 10^9$. See the sample input format for better understanding.

Note1: It is guaranteed that the given array is sorted in **non-decreasing** order.

Note2: It is also guaranteed that the queries are valid. Which means, for each query $[x, y]$, $x \leq y$.

Output
For each query $[x, y]$, output a single integer P denoting the number of elements in the array a such that $x \leq a_i \leq y$.

Example

input Copy
```
5 3
10 20 20 45 79
20 50
5 45
1 100
```
output Copy
```
3
4
5
```